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EC99-794 On-Farm Storage of Dry Edible Beans: A Survey of Nebraka Growers and Storage Guidelines

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A Survey of Nebraska Growers and Storage Guidelines

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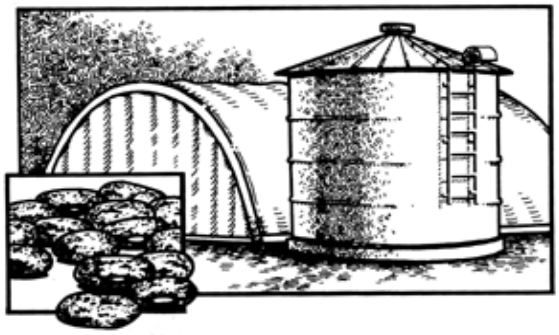

Dry edible bean producers in Nebraska typically deliver their crop to local bean dealers directly from the field, for either immediate sale or storage. Estimates are that less than 5 percent of Nebraska growers store part or all of their dry edible bean harvest in on-farm storage. In contrast, a much higher percentage of dry edible bean producers in other growing regions, particularly North Dakota and Michigan, use on-farm storage in their management plan. In Nebraska, corn and wheat producers are most likely to store all or part of their harvested grain on-farm.

Why do so few Nebraska dry edible bean producers store their crop on-farm? Are dry edible beans difficult to store? Are highly specialized handling and storage facilities required? Do storage and handling costs exceed any economic advantage to on-farm storage? Is marketing the crop stored on-farm difficult and unpredictable? Are storage and handling losses excessive? A University of Nebraska survey sought answers to these questions. The results are summarized here.

A Survey of On-Farm Storage of Dry Edible Beans in Nebraska

The Nebraska Dry Bean Grower's Association asked the University of Nebraska to conduct a survey of the state's dry edible bean producers who use or have used on-farm storage. The purposes for the survey were to estimate the number of Nebraska growers who use on-farm storage and to gather information on how successful the practice has been.

In 1996, growers using on-farm storage were interviewed about their experiences. Their responses are summarized below.

Profile of producers who use on-farm storage for dry edible beans

- Most had used on-farm storage for at least five years, some intermittently for as long as 30 years.

- They commonly store for three to four months. In some instances Great Northern beans have been stored for up to three years.
- They typically store a major portion of their crop.
- Most use flat storage consisting of a metal building with a concrete floor; a few use upright, round metal bins.
- Most are relatively large producers, with typically 1,400 to 2,000 total crop acres and 200 to 800 acres of dry edible beans per year.
- A much lower percentage of growers in the North Platte River Valley use on-farm storage compared to growers in other parts of the state.
- All producers surveyed had previously used on-farm storage for corn and/or wheat.
- All had on-farm storage facilities that were almost always initially constructed for storage of machinery or other crops.
- Most producers using on-farm storage sold bulk to a processor or buyer, although a few cleaned and bagged their crops.
- Most sold FOB the farm, although a few hauled their stored beans to the buyer. In either case, the price and quality were usually discussed during an on-farm inspection by the buyer, but were determined upon delivery at the processor facility.
- On-farm storage of dry edible beans is a topic not publicly discussed in Nebraska; however, based on confidential interviews for this survey, it was estimated that in 1996 between 30 and 50 producers in Nebraska stored dry edible beans on farm (less than 5 percent of Nebraska growers). Five to 10 of these producers further "processed" their on-farm stored beans using bulk bagging, cleaning, and gravity table or electric eye separation.
- The quantity of dry edible beans stored on farm in Nebraska during the previous 10 years has increased at a very slow rate.

Processor concerns for on-farm storage

The major buyers and processors of dry edible beans have developed expertise in and have acquired equipment and facilities for handling and storing dry edible beans. Their expertise, equipment and facilities have evolved over many years. They express concerns that quality and overall industry efficiency will decrease if on-farm storage becomes popular.

Growers participating in the on-farm storage survey and several processors were asked to respond to these concerns:

Issue	*Grower Response*	*Processor Response*
Seed damage which occurs	Estimated seed damage increased less than 1/2 percent during on-farm storage.	On-farm storage averages 10 percent during handling and storage loss from splits and cracks. Processors must use extensive processing to eliminate increased quality problems.
Other major storage problems	No major quality problems experienced.	Major quality problems have occurred with on-farm storage due to rodents, birds, molds and chemical contamination. Pintos stored over six months have changed color. Beans received from on-farm storage often must be sorted two to three times. Growers don't handle the seeds as a product for human consumption.

Storage insurance	Growers use blanket farm policy to insure stored crop, however to be properly insured the stored crop must be itemized on the blanket policy at a cost of 30 cents to 50 cents per cwt.	Processors are bonded and insured.

Why do growers use on-farm storage for dry edible beans?

Selling price, control of unsold beans, and processor storage costs were reasons cited in the survey for using on-farm storage. Growers indicated they could negotiate a better price for stored beans if they maintained control of the storage. All growers interviewed cited a $2 to $5/cwt. price premium over the posted processor price when sold to processors from on-farm storage. Some growers believed that their cost of storage was minimal since they already had a facility not being used for other crops or machinery. Most producers interviewed were reluctant to share detailed histories of storage and selling prices; however, of those that did about 75 percent achieved their target price for cost of production, storage and profit. These producers were reluctant to sell below their costs of production and used on-farm storage to select a selling time and price. Interviewed producers said they used the following guidelines to make their storage and selling decisions for Great Northern, pinto, and light red kidney beans:

Cost of production = $12-$15/cwt
Storage cost = $1-$2/cwt
Minimum profit target = $2-$3/cwt

Verified price premiums were $1 to $3/cwt over the average price posted at area processors. Processors contend that on a rising market they have offered $1 to $2/cwt over the posted price on an up market to growers with beans stored at the processor's facility. Processors indicated that price premiums will seldom be offered for on-farm stored beans. Processors may offer a premium for the best quality beans stored on-farm to fill a specific tender offer. This constitutes a very "thin" market for on-farm stored beans. If the practice of storing dry beans on farm increases, these premiums will disappear.

All growers contacted in this survey stated they will continue to use on-farm storage because the practice has, over time, increased their marketing options and increased their net income from the crop. All growers interviewed cited specific practices that were necessary for success and profit. All stated that if proper techniques were followed, dry beans were as easy if not easier to store on-farm than corn or wheat; however, they also stated that if these techniques were not followed, storage loss could be very high. Processors who receive both grain and beans contend that beans require more management than other stored grains.

Guidelines for Storing Dry Edible Beans On Farm

Harvest

Successful storage begins with attention to details at harvest. Foreign material must be minimized. Excess plant material, fines, broken bean parts, and soil can create temperature or moisture control problems during storage. Excess soil can cause staining on the bean seed. Thoroughly cleaning out the combine before bean harvest, especially if the last crop harvested was corn, is essential. Also carefully clean out trucks, conveyors and the storage area. Only a few kernels of corn found during inspection can

cause rejection of the entire truck load.

Combine at the highest seed moisture permitted by the storage facilities. If drying is available, consider combining at 16 to 18 percent moisture content to minimize seed damage during combining and handling into storage. If aeration is available (it is always recommended), attempt to harvest at 13 to 15 percent moisture content. If the storage facilities have no aeration or drying capabilities, the beans should be harvested at 11 to 12 percent moisture content.

Seed damage must be minimized during combining and must be less than the damage level considered acceptable for a desired grade level when delivering to a receiving facility. The on-farm storage process will always increase seed damage, but careful planning and handling of the seed can minimize the damage. Seed with low mechanical damage will have the highest potential for marketing from on-farm storage. Seed with high mechanical damage, or other quality problems, going into storage will be difficult to market from on-farm storage. Do not harvest at excessive moisture contents because bean seed will spoil if too moist and not properly dried or aerated. Musty or spoiled beans cannot be sold for human consumption.

Shrinkage significantly affects price. The common practice is for the processor to shrink the delivered weight to 14.5 percent moisture content, if the moisture content is over 14.5 percent. No premiums are paid for beans delivered below this moisture content. This shrink delivered weight is the pay weight if stored with the processor. Depending on length of storage, additional moisture shrink may amount to as much as 4 percent. Also, as storage time accumulates, additional storage losses of up to 4 to 6 percent may occur due to handling, i.e. cracks and splits.

At a 3 cents per cwt per month storage fee, moisture shrink and storage losses are not recovered by the processor. Based on the delivered pay weight, a 10 percent shrink or storage loss incurred by the producer during on-farm storage may eliminate any reported price premiums depending on price levels. Storage is a cost to the processor and producer. Stored on-farm, these losses would be a cost absorbed by the producer. Beans must be weighed into and out of storage to properly quantify shrink.

Placing beans into storage

Beans are stored in round metal bins and in flat storage. Metal bins almost always have perforated aeration floors. Some may have drying equipment. Any in-bin augers for unloading or stirring must have bristle, not steel auger flighting, and should be operated at slow speeds to minimize seed damage. Some bins have floors that slope to the center or to one side to eliminate the need for the circulating bottom unloading auger. Avoid augers whenever possible.

Flat storage is commonly used for edible beans. The building should have a flat concrete floor that is free of cracks, completely dry, with no oil or chemical stains or spills. Walls, roofs and doors must keep out rodents, birds and water. The building should not be used for any other purpose. Storing machinery in the same building could impart an objectionable diesel odor on the beans. Do not use any part of the same building for other purposes, such as a farm shop, to avoid dust and odors which can be absorbed by the beans. Do not store pesticides, fertilizers, seed beans or other crop seed, or other chemicals in the same building. These materials can cause a detectable odor in the beans.

Wooden walls or bulk heads are preferred in flat storage to prevent "sweating" when beans contact metal walls. Aeration ducts should always be placed on the floors of flat storage to maintain proper moisture and temperature conditions.

Never use conventional grain augers with steel flighting to unload beans from the truck into either bin or flat storage. Instead, use only a rubber belt conveyor or a bristle flighted auger at slow rotational speed. Always use "bean ladders" to limit the free fall distance of beans when putting beans into either a bin or flat storage. Generally, beans should not be allowed to free fall more than four feet from unloading conveyors to bin floors or to the surface of the bean pile. Bean ladders can be purchased or made easily from wood. Some growers have constructed bean ladders from car or truck tires to limit free fall distance. Lower the conveyor discharge to reduce drop distances.

Storage period

Regularly monitor the condition of stored beans. Check moisture content and temperature to determine the need for aeration. Any drying must be done slowly, with very low drying temperatures. Bean seed can be easily damaged by excessive temperatures. Temperatures considered safe for crops such as corn or wheat may cause damage to dry edible bean seed. Generally, air temperature of less than 20° F above outside air temperatures should be used. Never use air drying temperatures above 110° F. Air flow rates for natural air drying or heated air drying should be at least 1 cfm per bushel. Clean beans at 13 percent moisture content or below can be adequately aerated to maintain a stable temperature and moisture content with air flows of 0.1 cfm per bushel.

Allow no water leaks, even small leaks, through roofs, walls or floors. Prevent rodents, pets and birds from entering the storage building. These pests will not eat the beans but will walk across them. Any trace of urine or feces found in the beans will cause rejection of all beans in the facility. Remember, beans are destined for direct human consumption.

Regularly walk across the surface of beans in storage. This will loosen any "crusting" of the surface layer and aid aeration. This also provides an opportunity to monitor the moisture, temperature and general condition of the beans. Follow all stored grain and bin safety measures when entering grain bins or walking on piles on flat storage.

Growers interviewed in the on-farm storage survey consistently reported losing two percentage points of moisture during storage. This will depend on harvest moisture and the amount of drying which occurs during storage. This moisture loss must be anticipated and considered as a "shrinkage" or storage loss when comparing selling the beans from the field or storing at a bean processor.

Removing beans from storage

The moisture content of beans will often drop to 10 to 12 percent after several months of storage. At these low moisture levels, the seed is easily damaged. Seed damage in beans stored on-farm will be higher than damage in the same beans if they had been delivered directly from the combine to the bean buyer. Any additional degradation of quality during storage or handling into and out of storage will reduce marketability of part or all of the stored crop. This could negate any potential price benefit of on-farm storage. Monitor seed damage carefully and often during the loading-out process. Stop and adjust the process if new seed damage is found.

If round bins have a bottom unloading auger, replace the steel flighting with bristle flighting and operate at a slow speed, preferably less than 200 rpm. This will likely reduce unloading capacity, so consider increasing the diameter of the unloading auger. Use a rubber belt conveyor to move the beans from the bin unloading auger or from the bottom of the bin into the truck. Minimize the drop distance from the end of the conveyor into the truck by lowering the conveyor or using a bean ladder.

Beans in flat storage are usually moved with a front-end loader directly from the building floor into the truck. This type of operation can cause high levels of bean damage if not done properly. The bucket blade edge must be straight, maintained level with the floor, and held against the floor to minimize bean crushing. Sweep the area just lifted and between the bean pile and truck often. Discard the sweepings. Continued driving over spilled or missed beans will quickly increase bean damage or bean loss to unacceptable levels. Keeping the leading edge of the bucket against the floor, level with the floor, and sweeping often are necessary for successful unloading of flat storage.

Major storage and handling problems

Although on-farm storage of dry edible beans is relatively straight forward, paying close attention to several aspects of the practice are critical for success. Experienced growers using on-farm storage cited several practices that have led to serious problems:

- **Seed moisture content too high or too low going into storage.** If the seed moisture is too high and cannot be lowered with available drying or aeration equipment, seed spoilage will result. If the seed moisture content is too low going into storage, excess seed damage can occur during unloading and reloading.

- **Excessive handling damage.** Handling during on-farm storage will always add some mechanical damage. Bean seed is more prone to mechanical damage than most other seeds such as corn, soybeans, and wheat. Proper equipment and careful handling can minimize this damage to acceptable levels. Growers who responded to the survey emphasized that handling damage can be very high if proper handling techniques are not used.

- **Water leaking through roofs, walls, or floors.** Leaking water will cause "caking" of beans and spoilage. This will require disposing of complete sections of the stored beans and/or major discounting of price. Any moldy beans must be discarded.

- **Rodents and birds.** Rodents and birds must be kept out of the storage area. Any detection of the presence of the pests often will cause rejection of the entire storage area.

- **Insects.** Insects are not ordinarily a problem in stored beans unless they are attracted by some other material mixed with the beans or stored adjacent to the beans.

- **Mold.** Dry beans can mold. The mold can be caused by moisture leaking into the storage area, because the moisture content of the beans was too high at harvest, or because no aeration was provided. Even the slightest detection of mold will be cause for rejection of all beans in that stored area.

- **Oils, chemicals, fuel, and other contaminates.** These materials must not be stored in the same building. Any spills that soaked into the concrete floor in previous years can cause staining, odors and contamination of the beans. These problems must be avoided to prevent rejection of all beans stored in this facility.

- **Contamination by any previous stored grain**, i.e., corn, will result in additional processing costs, or rejection.

- **Mixing bean classes or even certain varieties of the same class**, can result in additional processing costs, or rejection.

On-farm storage is used by a limited number of dry edible bean growers to successfully increase marketing options and improve financial returns. Using this practice is partially determined by the availability of proper storage facilities and the quantity of beans harvested. If not done correctly with attention to marketing and storage details, on-farm storage of edible beans can lead to major problems and major losses. Like any other agricultural process or practice, on-farm storage must be done with the proper equipment and facilities, and with a good understanding of the complete process. Factors essential to success are storage management, bean handling into and out of storage, financial management, and in particular, discipline for accepting price targets. Unlike most other field crops, dry edible beans will be used directly, and in whole form, for human consumption and require careful management during handling and storage.

Recommended Further Reading for Storage, Aeration, and Drying of Dry Edible Beans

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